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TABLE OF CONTENTS

ANTERIOR BOW-LEGS. Wallace Blanchard, M. D., F. A. C. S., Chicago Ill..... 1
CONGENITAL SYPHILITIC EPIPHYSITIS IN ADOLESCENCE. E. J. Gaenslen, M. D., F. A. C. S., and W. M. Thalheimer, M. D., Milwaukee, Wis..... 8
CRITICAL COMMENTS ON A PAPER ENTITLED "ASTRAGALECTOMY IN PARALYTIC FEET." Royal Whitman, M. D., New York..... 18
THE TREATMENT OF FRACTURES. H. Winnett Orr, M. D., F. A. C. S., Lincoln, Nebr. 23
NEWS NOTES 28
BIBLIOGRAPHY 29
ABSTRACTS 33

ROBERT LINDER

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Index. Volume xix.

INDEX OF AUTHORS

A

Adams, Z. B. Statistical Report of Commission on Congenital Dislocation of Hip, for 1921. p. 357. Analysis of seventeen fractures of Neck of Femur. p. 555.
Allison, Nathaniel. Teaching of Orthopaedic Surgery. p. 448.

B

Baer, W. S. Report of Commission Appointed to Investigate Results of Ankylosing Operations on Spine. p. 507.
Blanchard. Wallace. Anterior Bow-Legs. p. 1.
Blanco, Pio. Report of Case of Loose Osteocartilaginous Bodies in Knee Joint. p. 104.
———. Giant-Cell Tumor in Knee Joint. p. 156.
Brackett, E. G. Report of Commission Appointed to Investigate Results of Ankylosing Operations on Spine. p. 507.
Brown, Maud Forrester. Possibilities of Suture After Extensive Nerve Injury. p. 277.

C

Calvé, Jacques. Osteochondritis of Upper Extremity of Femur. p. 489.
Campbell, Willis C. Arthroplasty of Knee. Report of Cases. p. 430.
Clark, William Arthur. Protractor for Measuring Rotation of Joints. p. 154.
Cook, Ansel G. Report of Commission on Stabilizing Operations upon Foot. Part I. p. 437.
Cotton, Albertus. Reconstructive Surgery of Traumatic Foot and Ankle Deformities. p. 196.

E

Eikenbary, C. F. Fracture or Avulsion of Lesser Trochanter. p. 464.

F

Fiske, Eben W. Present Tendencies in Treatment of Congenital Club Foot. p. 668.
Fisher, Arthur L. Correspondence. p. 709.
Freiberg, A. H. Removal of Meniscus from Knee Joint. p. 697.

G

Gaenslen, E. J., and Thalheimer, W. M. Congenital Syphilitic Epiphysitis in Adolescence. p. 8.
Gibson, Alexander. Some Aspects of Mechanics of Human Foot in Walking. p. 188.
Gill, A. B. End Results in Operative Procedures for Infantile Paralysis with Special Reference to Tendon Transplantation at Widener Training School for Crippled Children. p. 677.
———Stoffel's Operation for Spastic Paralysis with Report of Thirty-two Cases. p. 52.
Goldthwait, Joel E. Report of Commission on Congenital Dislocation of Hip. p. 353.
Greenough, Robert B. Bone Sarcoma. Analysis of Cases Admitted to Massachusetts General Hospital and Collis P. Huntington Memorial Hospital from January 1, 1911, to January 1, 1921. p. 602.
Grossman, Jacob. Fracture of Forearm in children. p. 217.

H

Harmer, Torr W. Bone Sarcoma. Analysis of Cases Admitted to the Massachusetts General Hospital and Collis P. Huntington Memorial Hospital from January 1, 1911, to January 1, 1921. p. 602.
Hawley, G. W. End Results in Fractures of Knee and Ankle. p. 542.
Henderson, Melvin S. Fractures of Femur. End Results. p. 520.
Hoke, Michael. Operation for Stabilizing Paralytic Feet. p. 494.

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INDEX OF AUTHORS

A

Adams, Z. B. Statistical Report of Commission on Congenital Dislocation of Hip, for 1921. p. 357. Analysis of seventeen fractures of Neck of Femur. p. 555.

Allison, Nathaniel. Teaching of Orthopaedic Surgery. p. 448.

B

Baer, W. S. Report of Commission Appointed to Investigate Results of Ankylosing Operations on Spine. p. 507.

Blanchard. Wallace. Anterior Bow-Legs. p. 1.

Blanco, Pio. Report of Case of Loose Osteocartilaginous Bodies in Knee Joint. p. 104.

———. Giant-Cell Tumor in Knee Joint. p. 156.

Brackett, E. G. Report of Commission Appointed to Investigate Results of Ankylosing Operations on Spine. p. 507.

Brown, Maud Forrester. Possibilities of Suture After Extensive Nerve Injury. p. 277.

C

Calvé, Jacques. Osteochondritis of Upper Extremity of Femur. p. 489.

Campbell, Willis C. Arthroplasty of Knee. Report of Cases. p. 430.

Clark, William Arthur. Protractor for Measuring Rotation of Joints. p. 154.

Cook, Ansel G. Report of Commission on Stabilizing Operations upon Foot. Part I. p. 437.

Cotton, Albertus. Reconstructive Surgery of Traumatic Foot and Ankle Deformities. p. 196.

E

Eikenbary, C. F. Fracture or Avulsion of Lesser Trochanter. p. 464.

F

Fiske, Eben W. Present Tendencies in Treatment of Congenital Club Foot. p. 668.

Fisher, Arthur L. Correspondence. p. 709.

Freiberg, A. H. Removal of Meniscus from Knee Joint. p. 697.

G

Gaenslen, E. J., and Thalheimer, W. M. Congenital Syphilitic Epiphysitis in Adolescence. p. 8.

Gibson, Alexander. Some Aspects of Mechanics of Human Foot in Walking. p. 188.

Gill, A. B. End Results in Operative Procedures for Infantile Paralysis with Special Reference to Tendon Transplantation at Widener Training School for Crippled Children. p. 677.

———Stoffel's Operation for Spastic Paralysis with Report of Thirty-two Cases. p. 52.

Goldthwait, Joel E. Report of Commission on Congenital Dislocation of Hip. p. 353.

Greenough, Robert B. Bone Sarcoma. Analysis of Cases Admitted to Massachusetts General Hospital and Collis P. Huntington Memorial Hospital from January 1, 1911, to January 1, 1921. p. 602.

Grossman, Jacob. Fracture of Forearm in children. p. 217.

H

Harmer, Torr W. Bone Sarcoma. Analysis of Cases Admitted to the Massachusetts General Hospital and Collis P. Huntington Memorial Hospital from January 1, 1911, to January 1, 1921. p. 602.

Hawley, G. W. End Results in Fractures of Knee and Ankle. p. 542.

Henderson, Melvin S. Fractures of Femur. End Results. p. 520.

Hoke, Michael. Operation for Stabilizing Paralytic Feet. p. 494.

409054

J

Jansen, Murk. Cause of Coxa Plana. p. 706.
———Dysostosis Cleido-Cranialis. p. 468.
———Hallux Valgus, Rigidus and Malleus. p. 87.
Jones, Sir Robert. Manipulation of Stiff Joints. p. 385.

K

Kidner, F. C. Low Grade Infections of Vertebral Bodies, Probably Staphylococcal. p. 459.

L

Levick, G. Murray. Musculature of Foot, and Treatment by Electricity. p. 317.
Little, E. Muirhead. Supply of Artificial Limbs to War Amputees in England. p. 307.
Lowman, C. L. Preventive and Prophylactic Orthopaedic Practice. p. 576.

M

Meyerding, H. W. Congenital Torticollis. p 91.
Mumford, E. B. Primary Osteomyelitis of Patella. Case Report. p. 583.

O

Ober, F. R. Some Points on Immobilization of Septic Knee Joints. p 689.
O'Reilly, Archer. Backache and Anatomical Variations of Lumbo-Sacral Region. p. 171.
Orr, H. Winnett. Treatment of Fractures. p. 23.
Osgood, Robert B. Presidential Address 1921. Backgrounds of Orthopaedic Surgery. p. 259.

P

Patek, Robert. Static Deformities as Factor in Production of So-called Hypertrophic Arthritis. p. 324.
Peckham, Frank E. Treatment of Fractures of Femur. p. 529.
Platt, Harry. Principles of Surgery of Peripheral Nerve Injuries of Warfare. p. 569.
Putti, V. Arthroplasty. p. 421.

R

Ridlon, John. Lessons from My Own Experience with Congenital Dislocation of Hip. p. 365.
Robinson, Wilton H. Joint Range. p. 41.
Rugh, J. T. Report of Commission Appointed to Investigate Results of Ankylosing Operations on Spine. p. 507.

S

Schauffler. R. McE. Curative Play System of Children's Mercy Hospital of Kansas City, Missouri. p. 98.
Sever, J. W. Removal of Astragalus in Paralytic Feet. Results in Two Hundred and Seventeen Cases. p. 35.
Simmons, Channing C. Bone Sarcoma. Analysis of Cases Admitted to the Massachusetts General Hospital and Collis P. Huntington Memorial Hospital from January 1, 1911, to January 1 1921. p. 602.
Slomann. Correspondence. p. 711.
———On Coalitio Calcaneo Navicularis. p. 586.
Smith, S. Alwyn. Fractures Occurring in Bone Grafts. p. 270.
Smith-Petersen, M. N. Arthrodesis of Sacroiliac Joint. New Method of Approach. p. 400.
Soule, Robert E. Treatment of Sprain Fracture of Tubercle of Tibia in Adolescence (Osgood-Schlatter Disease). p. 550.
Steindler, Arthur. Operative Methods and End Results of Disabilities of Shoulder and Arm. p. 652.
Stephens, Richmond. Osteomyelitis Following War Injuries. p. 138.
Stern, Walter G. Chronic Circumscribed Osteomyelitis. p. 132.
———Report of Commission on Stabilizing Operations Upon Foot. Part II. p. 444.
Stone. James B. Fractures of Elbow in Children. p. 395.

T

Teece, Lennox G. Application of Muscle Physiology to Treatment of Paralysis. p. 405.
Thalheimer, W. M., and Gaenslen, E. J. Congenital Syphilitic Epiphysitis in Adolescence. p. 8.
Truslow, Walter. Non-Operative Treatment of Scoliosis. p. 121.
Turner, W. G. Myeloma of Vertebrae. p. 698.

W

Whitman, Royal. Correspondence. p. 18, p. 708, p. 710.
Observations on Operative Treatment of Scoliosis. p. 330.

INDEX OF ORIGINAL COMMUNICATIONS.

A

American Orthopedic Association, Officers and Committees. p. 336.
Ankle, End-Results in Fractures of Knee and, G. W. Hawley. p. 542.
Arthritis, So-Called Hypertrophic, Static Deformities as Factor in Production of. Robert Patek. p. 324
Arthrodesis of Sacroiliac Joint. New Method of Approach. M. N. Smith-Petersen. p. 400.
Arthroplasty. V. Putti. p. 421.
——**of Knee.** Report of Cases. Willis C. Campbell. p. 430.
Artificial Limbs, Supply of, to War Amputees in England. E. Muirhead Little. p. 307.
Astragalus, Removal of, in Paralytic Feet. Results in Two Hundred and Seventeen Cases. J. W. Sever. p. 35.
Avulsion or Fracture of Lesser Trochanter. C. F. Eikenbary. p. 464.
Backache and Anatomical Variations of Lumbo-Sacral Region. Archer O'Reilly. p. 171.
Bone Grafts, Fractures Occurring in. S. Alwyn Smith. p. 270.

B

Book Reviews. p. 110
Bow-Legs, Anterior. Wallace Blanchard. p. 1.

C

Club-Foot, Congenital, Present Tendencies in Treatment of. Eben W. Fiske. p. 668.
Coalitio Calcaneo-Navicularis. Slomann. p. 586.
Congenital Dislocation of Hip, Lessons from my Experience with. John Ridlon. p. 365.
——, Report of Commission on. Joel E. Goldthwait. p. 353.
——, Statistical Report of Commission on, for 1921. Z. B. Adams. p. 357.
Correspondence.
Carpal Injuries. Arthur L. Fisher. p. 709.
Further Case of Coalitio Calcaneo Navicularis, Slomann, p. 711.
Critical Comments on a Paper Entitled "Astragalectomy in Paralytic Feet." Royal Whitman. p. 18.
Fracture of Hip. Royal Whitman p. 710.
Operative Treatment of Scoliosis, Royal Whitman. p. 708.
Coxa Plana, Cause of. Murk Jansen. p. 706.

D

Dysostosis Cleido-Cranialis. Murk Jansen. p. 468.

E

Editorial.
Reporting Results in Fracture. p. 109.
American Orthopedic Association. p. 288.
Journal of Orthopaedic Surgery. p 334.
Foreword for the year 1922. p. 649.
Elbow, Fractures of, in Children. James S. Stone. p. 395.
Epiphysitis, Congenital Syphilitic, in Adolescence. E. J. Gaenslen and W. M. Thalheimer. p. 8.

F

Femur, Analysis of Seventeen Fractures of Neck of. Z. B. Adams. p. 555.
——, Fractures of. End Results. Melvin S. Henderson. p. 520.
Foot and Ankle Deformities, Traumatic. Reconstructive Surgery of. Albertus Cotton. p. 196.
——, Human, in Walking, Some Aspects of Mechanism of. Alexander Gibson. p. 188.
——, Musculature of, and Treatment by Electricity. G. Murray Levick. p. 317.
——, Report of Commission on Stabilizing Operations Upon. Part I. Ansel G. Cook. p. 437. Part II. Walter G. Stern. p. 444.

Forearm. Fracture of, in Children. Jacob Grossman. p. 217.
Fracture, Avulsion or, of Lesser Trochanter. C. F. Eikenbary. p. 464.
———of Forearm in Children. Jacob Grossman. p. 217.
Fractures Occurring in Bone Grafts S. Alwyn Smith. p. 270.
———of Elbow in Children. James S. Stone p. 395.
———, Femur, End Results, Melvin S. Henderson. p. 520.
———, Treatment of, Frank E. Peckham. p. 529.
———Knee and Ankle. End Results in. G. W. Hawley. p. 542.
——— Neck of Femur, Analysis of Seventeen. Z. B. Adams. p. 555.
———, Treatment of. H. Winnett Orr. p. 23.

G

Giant-Cell Tumor in Knee Joint. Pio Blanco. p. 156.
Gillette, Arthur J. Obituary. p. 158.

H

Hallux Valgus, Rigidus and Malleus. Murk Jansen. p. 87.

I

Infections, Low Grade, of Vertebral Bodies, Probably Staphylococcal F. C. Kidner. p. 459.

J

Joint Range. Wilton H. Robinson. p. 41.

K

Knee and Ankle. End Results in Fractures of. G. W. Hawley. p. 542.
Knee, Arthroplasty of. Report of Cases. Willis C. Campbell. p. 430.
———**Joint,** Giant-Cell Tumor in, Pio Blanco. p. 156.
———, Removal of Meniscus from. A. H. Freiberg. p. 697.
———, Report of Case of Loose Osteocartilaginous Bodies in. Pio Blanco. p. 104.
Knee Joints, Septic, Some Points on Immobilization of. F. R. Ober. p. 689.

L

Lumbo-Sacral Region, Backache and Anatomical Variations of. Archer O'Reilly. p. 171.

M

Manipulation of Stiff Joints. Sir Robert Jones. p. 385.
Muscle Physiology, Application of, to Treatment of Paralysis. Lennox G. Teece. p. 405.
Myeloma of Vertebrae. W. G. Turner. p. 698.

N

Nerve Injuries, Peripheral, of Warfare, Principles of Surgery of. Harry Platt. p. 569.
——— **Injury,** Extensive, Possibilities of Suture After. Maud Forrester Brown. p. 277.
News Notes.—pp. 28, 82. 112, 164, 253, 337, 418, 470, 560.

O

Obituary.
Arthur J. Gillette. p. 158.
———, Memorial to. p. 246.
Orthopaedic Practice, Preventive and Prophylactic. C. L. Lowman. p. 576
——— **Surgery,** Backgrounds of, Presidential Address. Robert B. Osgood. p. 259.
———, Teaching of. Nathaniel Allison. p. 448.
——— **Titles in Current Literature.** pp. 29, 77, 114, 161, 255, 293, 338.
Osteocartilaginous Bodies, Loose, in Knee Joint, Report of Case of. Pio Blanco. p. 104.
Osteochondritis of Upper Extremity of Femur. Jacques Calvé. p. 489.
Osteomyelitis, Chronic Circumscribed. Walter G. Stern. p. 132.
———, Following War Injuries. Richmond Stephens. p. 138.
———, Primary, of Patella. Case Report. E. B. Mumford. p. 583.

P

Paralysis, Application of Muscle Physiology to Treatment of. Lennox G. Teece. p. 405.
———, Infantile, End Results of Operative Procedures for, with Special Reference to Tendon Transplantation, at Widener Training School for Crippled Children. A. B. Gill. p. 677.

——, Spastic, Stoffel's Operation for, with Report of Thirty-two Cases. A. Bruce Gill. p. 52.
Paralytic Feet, Operation for Stabilizing. Michael Hoke. p. 494.
Patella. Primary Osteomyelitis of, Case Report. E. B. Mumford. p. 583.
Play System, Curative, of Children's Mercy Hospital of Kansas City, Missouri. R. McE. Schauffler. p. 98.
Presidential Address, 1921. Backgrounds of Orthopaedic Surgery. Robert B. Osgood. p. 259.
Program, American Orthopedic Association. pp. 165, 248.
Protractor for Measuring Rotation of Joints. William Arthur Clark. p. 154.

R

Rotation of Joints, Protractor for Measuring. William Arthur Clark. p. 154.

S

Sacroiliac Joint, Arthrodesis of. New Method of Approach. M. N. Smith-Petersen. p. 400.
Sarcoma, Bone. Analysis of Cases Admitted to Massachusetts General Hospital and Collis P. Huntington Memorial Hospital from January 1, 1911, to January 1, 1921. Robert B. Greenough, Channing C. Simmons, Torr W. Harmer. p. 602.
Scoliosis, Non-Operative Treatment of. Walter Truslow. p. 121.
——, Non-Operative Treatment of. Walter Truslow. p. 228.
——, Observations on Operative Treatment of. Royal Whitman. p. 330.
Shoulder and Arm, Operative Methods and End Results of Disabilities of. Arthur Steindler. p. 652.
Spine, Report of Commission Appointed to Investigate Results of Ankylosing Operations on. E. G. Brackett, W. S. Baer, J. T. Rugh. p. 507.
Sprain-Fracture of Tubercle of Tibia in Adolescence (Osgood-Schlatter Disease), Treatment of. Robert E. Soule. p. 550.
Static Deformities as Factor in Production of So-Called Hypertrophic Arthritis. Robert Patek. p. 324.
Stoffel's Operation for Spastic Paralysis, with Report of Thirty-two Cases. A. Bruce Gill. p. 52.

T

Tibia, Treatment of Sprain-Fracture of Tubercle of, in Adolescence (Osgood-Schlatter Disease). Robert E. Soule. p. 550.
Torticollis, Congenital. H. W. Meyerding. p. 91.

V

Vertebral Bodies, Low Grade Infections of, Probably Staphylococcal. F. C. Kidner. p. 459.

INDEX OF ABSTRACTS FROM CURRENT ORTHOPAEDIC LITERATURE.

A

Arthritis, Chronic, Second Great Type of. Leonard W. Ely. p. 300.

Atrophy, Quadriceps. Arthur Stoffel. p. 168.

B

Backache. S. Epstein. p. 478.

"Balkan" Frame, Adjustable Extension and Suspension. Nathaniel Allison. p. 486.

Bone and Joint Tuberculosis. Scharff. p. 40.

———atrophy. An Experimental and Clinical Study of Changes in Bone which result from None-use. Hodgson. p. 713.

——— flap, Cutting in cranial surgery. H. C. Masland. p. 300.

——— grafting: Study of cases operated upon in U. S. Army Hospitals. J. B. Walker. p. 417.

———repair, Rib Grafting Operations for, and their end-results at Letterman Hospital. Eloesser. p. 37.

——— sinuses, persistent, Study of. Charles Peabody. p. 303.

——— transplantation, Autogenous. Melvin S. Henderson. p. 483.

Brachial Plexus, Surgical aspects of injuries of. Alfred W. Adson. p. 565.

C

Cancellous Tissue, Rôle of, in healing bone. T. Wingate Todd. p. 344.

Cartilage, Transplantation of. W. T. Coughlin. p. 304.

Congenital Dislocation of hip, Anterior torsion of upper end of femur in. Froelich. p. 471.

Crippled Children, For better treatment of. H. L. Langnecker. p. 483.

Cysts, Development of, in connection with external semilunar cartilage of knee-joint. K. Ollenenshaw. p. 480.

D

Dental Caries, Comparative frequency of, among tuberculous. P. Fargin Fayolle. p. 168.

Dislocated Elbow, After-treatment of. Ernest Sanger. p. 304.

Dislocation, Bilateral forward, of fifth cervical vertebra with reduction by manipulation. Mitchell Langworthy. p. 561.

———, Downward, of patella. H. Rutherford. p. 643.

———, Habitual or recurrent, of shoulder. T. T. Thomas. p. 476.

——— of elbow, After-treatment of. Seeger. p. 86.

——— of Sacroiliac joint. Alexander Gibson. p. 343.

———, recurrent, of shoulder joint: Mechanical consideration of treatment. J. W. Sever. p. 416.

Dislocations of hip, treatment of long standing. J. Schoemaker. p. 476.

——— of semilunar carpal bones Isador Cohn. p. 417.

E

Elbow, Observations on normally developing. Isadore Cohn. p. 483.

———, Mobilization of the, by Free Fascia Transplantation. Hodgson. p. 712.

Endothelioma of cauda equina. Morgan and Roberts. p. 85.

Epicondylitis Humeri. Louis Carp. p. 346.

F

Femur, Operative lengthening of Vittorio Putti. p. 640.

Fracture, Delay of healing of, and influence of war nutrition. U. Hammer. p. 168.

———, Fissure, of Tibia. Jacob Grossman. p. 305.

———, Recent, of os calcis. New method of treatment. David C. Strauss. p. 477.

——, Stave, of first metatarsal bone. M. B. Cooperman. p. 416.
——, Ununited, of neck of femur, End-results of reconstruction operation for. Armitage Whitman. p. 641.
Fractures and osteotomies, Temporary nailing of fragments in. Johannes Elsner. p. 299.
——, Comminuted, of the mandible, Treatment of. Potts. p. 39.
—— of cervical vertebrae with cord injury, Nonoperative treatment of. Michael Osnato. p. 565.
——, Ununited, of neck of femur, Treatment of, by bone transplants. Charles Davison. p. 640.

H

Humerus, Non-union of: Repair by means of bone graft. M. S. Henderson. p. 418.
Hydrarthosis, Intermittent. Walter L. Bierring. p. 645.

I

Iliosacral Joint. H. R. Allen. p. 645.
Infraction of second metatarsal head. C. F. Painter. p. 477.
Intrapelvic, Extra-Peritoneal Resection of the Obturator Nerve. Steindler. p. 713.

K

Knee, Lesions of, in ex-soldiers. F. J. Cotton. p. 561.
Kyphosis Dorsalis Juvenilis. Steindler. p. 715.

L

Lumbar Vertebrae. Fracture of Transverse Processes of. Davis. p. 712.

M

Malformation of toes in both feet. Rare case of. Stoffel. p. 84.
Massage, Centripetal, of scar tissue. Szenes. p. 85.
Myositis ossificans traumatica, Consideration of etiologic factors in. Charles F. Painter. p. 481.

N

Needle, Recovery of, from tendon of flexor longus hallucis. W. Howard Barber. p. 299.
Nerve injuries, Peripheral, of warfare, Surgery of. H. Platt. p. 482.
—— lesions, Two unusual. Alexander Gibson. p. 298.
—— suture. Edwin M. Miller. p. 345.

O

Orthopaedic Surgery and industrial surgery of extremities and spinal column, Standardization of methods of treatment in. R. B. Osgood. p. 484.
Osteomyelitis, Hemorrhagic, of femur. P. G. Lacroix. p. 564.
Osteosarcoma, Some difficulties in diagnosis of. Cofield. p. 53.

P

Paget's Disease of bones with positive Wassermann reaction. Vallery-Radot, Stevenin and Fatou. p. 563.
Paralysis, Infantile, Operative treatment of. p. 301.
Paraplegia, Case of, in which second cervical vertebra was removed. J. Hogarth Pringle. p. 644.
Post-Typhoid Bone and Joint Disease, Diagnosis of. Emile Weil. p. 564.
Posture, Effect of, on health of child. Frank D. Dickson. p. 644.
——, Principles of, with special reference to mechanics of hip-joint. Mabel Elsworth Todd. p. 479.
——in Relation to Medical and Surgical Problems. Meyerding. p. 715.

R

Rachitis, Two cases of generalized late. Rendu and Werteimer. p. 479.
Radius and Ulna, Delayed union and nonunion of. H. W. Meyerding. p. 642.
——, Pathology of curvature of. Pilatte. p. 482.
Rickets, Cure in infantile, by sunlight: Preliminary Note. Alfred F. Hess and Lester J. Unger. p. 479.
Rickets, Late, and its relation to chronic diseases. Fromme. p. 33.
Rupture of tendon of insertion of biceps flexor cubiti. John Joseph Nutt. p. 564.

S

Sciatica, a symptom or a clinical entity? William J. Leszynsky. p. 566.
——, Mechanical influences in. E. W. Fiske. p. 562.

Scoliosis. S. Kleinberg. p. 478.
———, Case of, treated by extensive resection of ribs. Swynghdauw. p. 118.
——— ischiadica alternans. A. Blencke. p. 646.
Semilunar Cartilage, Derangement of. Louis Strahlmann and J. W. White. p. 416.
Spinal Cord Tumor, False localizing signs of. Charles A. Elsberg. p. 346.
——— **Curves** in growing children. E. H. Bradford. p. 477.
Spondylolisthesis, Traumatic: Report of two cases. S. Kleinberg. p. 481.
Subluxation of head of radius. Grossman. p. 306.
Suture, End-to-End, of peripheral nerves, Methods to secure. Howard C. Naffziger. p. 348.
Syphilis, Cerebral, or cervical ribs. p. 481.

T

Tendinous Anastomosis for traumatic lesions of nerves. Mauclaire. p. 119.
Tenodesis of quadriceps tendon. Alfred Saxl. p. 299.
Trophic Ulcers following nerve severance, New explanation for formation and healing of. Bruening. p. 84.
Tuberculosis of Bone; Results of a Study. Nathaniel Allison. p. 475.
——— **of Hip:** Statistical study on 506 cases treated at Instituto Rizzoli. S. Vacchelli. p. 471.
——— **of Knee-Joint.** J. J. Kurlander. p. 346.
——— **of Spinal Column.** Valtancoli. p. 473.
Tuberculous Joint Effusion, Cytologic investigation of. Walter Penwy. p. 298.
Typhoid Spine. Barclay Moffatt. p. 417.
——— **Spondylitis,** Cure of, by vaccine therapy. Dufour, Debray and Guyard. p. 564.

W

Work Chair. Emmons Goldthwait. p. 715.

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ANTERIOR BOW-LEGS

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The literature of rachitic deformities of the legs in children, has not presented a case of extreme anterior bent tibias exhibiting a shortening of 10 cm. that has been corrected with a restoration to full length of the leg. After correcting many cases of anterior bent and shortened tibias with a lengthening of from 2.5 cm. to 10 cm. I feel justified in reporting upon them. Next to the correction of the deformity the patient that is dwarfed by anterior bent tibias prizes the restoration to normal stature. Anterior bent tibias so frequently complicate knock-knees and bow-legs that they cannot well be considered separately and occasionally these three deformities are so intermingled that it is a question which predominates.

Anterior bent tibia is seldom exclusively an anterior deformity except in the earliest stage for the reason that as the deformity progresses it usually goes to one side or other in the direction of the least resistance.

The most frequent type of anterior bent tibia is well shown in Fig. 1 (case 1.). The right tibia has a bend directly to the front and the left tibia has an out bend just as marked as its anterior bend. It will be seen that the apices of both deformity bends are close to the ankle joints. The fracturing bar of the Grattan osteoclast was placed against the outside of the legs and on a level with the apices of the deforming bends of the tibias.

After the lateral fracturing has been made complete the legs were straightened by manual force, causing the opening of triangular spaces in the posterior tibial shafts and the legs were fixed in plaster of Paris. The tendo Achilles of both legs had been previously tenotomized to permit of 2.5 cm. of lengthening. Six weeks later the patient, Fig. 2 (case 1.) was walking with symmetrical and perfectly functionating legs.

Occasionally the deformity of rachitic anterior bent tibia is so extreme in a child of from five to ten years of age that the distance from the heel to the posterior knee articulation is shortened over one half, making it evident that if a correction could be immediately accomplished it would destroy the vitality of the leg.

Fig. 3 (case 2.) shows a boy ten years of age with viciously deforming rachitic anterior and lateral bent tibias with all the

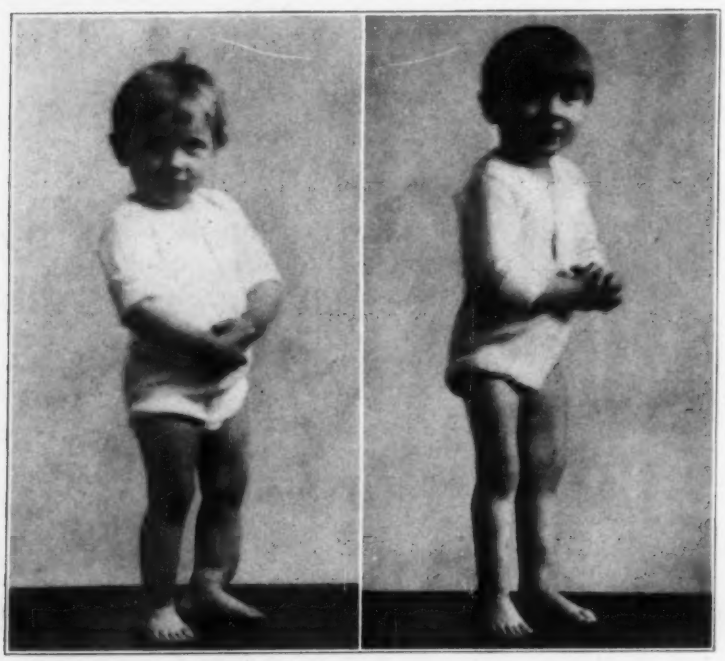

FIG. 1 (case 1)—Boy aged 5 years with anterior bent tibias of the usual type.

FIG. 2 (case 2)—Six weeks after correction by rapid osteoclasis and with a lengthening of 2.5 cm.

ankle and foot articulations deranged. The roentgenogram of the case, Fig. 4, shows the extent of the anterior bends in the tibias and fibulas and also the shortening of the legs. In this case the legs were straightened and lengthened 2.5 cm. at a time without in the least endangering the vitality of the parts. Four osteoclases were done at different levels and three or four months apart. Each lengthening of the tibia was accompanied by a simple transverse tenotomy of the tendo Achilles to permit of its lengthening to a corresponding degree. The other fibrous tissues as well as the arteries and nerves stretched without any unpleasant symptoms. Six weeks after each osteoclasis the plaster of Paris was removed and the 2.5 cm. of gap in the tendo Achilles was found to be filled with connective tissue and the tendon was practically reproduced.

Ample experience shows that three or four lengthenings of the tendo Achilles by simple division leaves its strength unimpaired. Experience also shows that the nerves and arteries do not suffer in the least from 10 cm. of lengthening if done 2.5 cm. at a time and three or four months apart. Fig. 5 shows case 2 after four osteoclases with accompanying tenotomies of the tendo Achilles in each leg resulting in functionally perfect legs with 10 cm. of lengthening.

Nearly half the cases of badly deforming knock-knees are accompanied by more or less pronounced anterior bends in the tibias. In the correction of the knock-knees by supracondyloid osteoclasis the direction of the tibias is so changed that in fully two-thirds of the cases the accompanying bent tibias are so nearly neutralized as to be practically obliterated. This is very well shown in Fig. 6 and 7 (case 3.) before and six weeks after bloodless supracondyloid osteoclasis and redressement.

In about every seventh case of knock-knees with accompanying anterior bent tibias the correction of the knock-knees only accentuates the anterior bent tibias making necessary a separate osteoclasis and redressement for their correction.

Occasionally mild anterior bends in the tibias accompany badly deforming bow-legs that are automatically corrected with the correction of the dominating deformities by bloodless osteoclases. Such a case of pronounced bow-legs with mild anterior bent tibias is shown in Fig. 8. In this case the picture shows

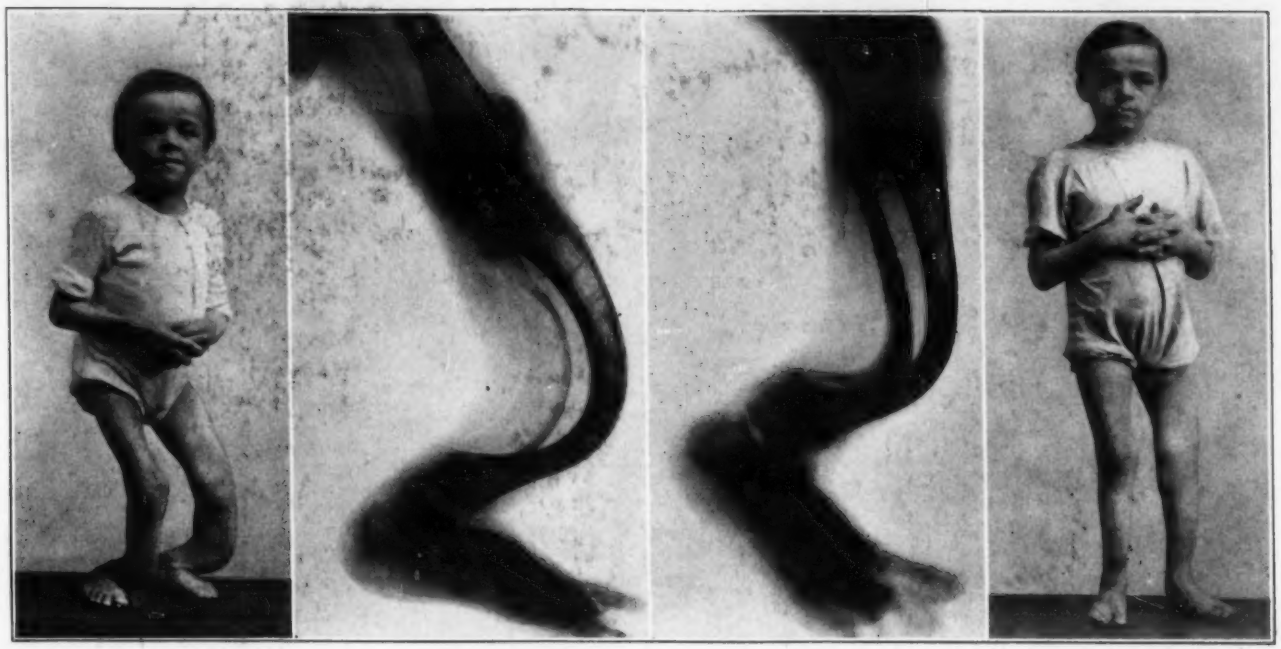

FIG. 3 (case 2)—Boy aged 10 years with legs shortened one half by anterior and lateral bent tibias.

FIG. 4.—Roentgenogram of case 2, showing the pronounced anterior bends and the shortening of the tibias.

FIG. 5 (case 2)—Showing perfectly functionating legs with 10 cm. of lengthening.

the anterior tibias but poorly because the patient faces directly to the front. The same case is shown in Fig. 9 six weeks after correction of both the pronounced bow-legs and the mild anterior bent tibias by the one operation on each leg of bloodless osteoclasis. Frequently when the three deformities of rachitic bow-leg, knock-knee and anterior bent tibias are intermingled in the same leg the correction of two of the deformities automatically corrects the third.

Non-unions after accidental or spontaneous fractures that are so frequently seen in the fragile bones of acute rickets are a constant warning against doing either an osteoclasis or osteotomy until eburnation is complete.

FIG. 6 (case 3)—Boy aged 6 years with pronounced knock knees accompanied by mild anterior bent tibias. This picture was taken to show the dominating deformity, and the anterior bent tibias are shown but poorly.

FIG. 7 (case 3)—Six weeks after rapid bloodless supracondyloid osteoclasis and showing that the correction of the knock-knees has neutralized the anterior bent tibias.

Dr. Robert W. Lovett's[1] rules for the roentgenographic differential diagnosis of the three stages of rickets should never be neglected. In the acute stage, the roentgenogram shows the epiphyses of the tibia clouded and blurred and with the ends of the diaphyses presenting a frayed out appearance. In the subacute stage the shadows begin to clear. With eburnation the normal roentgenographic clearness and regularity of outline returns and not until then should any corrective operation be attempted.

For several years at the Home for Destitute Crippled Children, Chicago, in addition to cleanliness and fresh air we have directed the following diet for our house and out cases.

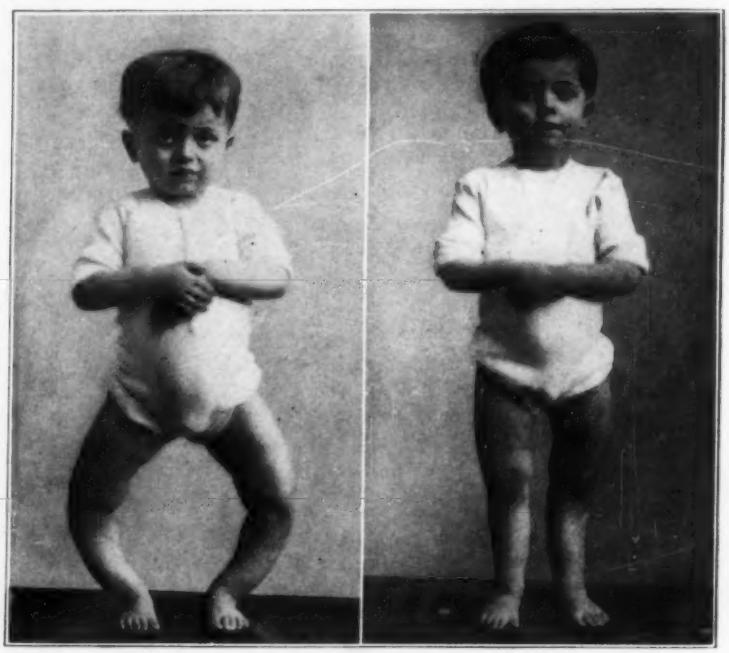

FIG. 8 (case 4)—Boy aged 6 years with pronounced bow-legs accompanying mild anterior bent tibias. This picture was taken to show the dominating deformity and the anterior bent tibias are shown but poorly.

FIG. 9 (case 4)—Six weeks after correction by rapid bloodless osteoclasis of the bow-legs and anterior bent tibias by the one operation.

[1]Lovett, Robert W.: Section on Orthopedic Surgery, A. M. A. 1915.

"Rachitic Diet. Orange juice, piece of broiled fat bacon, cereals with cream, rich milk, eggs, scraped or pressed beef juice, bread with much butter, phosphorized cod liver oil, one teaspoon at meals, vegetables. No tea or coffee."

With the cure of rickets the bones usually eburnate quite suddenly and frequently become harder and firmer than normal bone.

Non-unions following osteotomy are of frequent occurrence and are undoubtedly due to the interruption of bone continuity by the chisel and filling of the open space by extraneous materials. I have never had a non-union following osteoclasis and the only one I have known to occur was in the hands of a careful operator and it antedated Lovett's rule for determining eburnation or it would not have happened.

The fear has been expressed that when used to correct deformities close to joints "The osteoclast may slip over the end of the bone and injure the joint."

In twenty years of experience I have never seen a joint endangered by use of the Grattan osteoclast.

In Fig. 1 (case 1) the deformities will be seen to be very close to the lower ends of the tibias and the osteoclases were done as close to the ankle joints as one could desire to do osteotomies. In Fig. 6 (case 3) the supracondyloid osteoclases were done quite close to the condyles. In neither of these cases were the joints in the least danger.

Slow osteoclasis is dangerous and not over eight seconds should be taken for the fracturing of a bone in the osteoclast. A primary consideration in the end-result of any operation is the effect on the mental condition of the patient and the readers attention is called to the dejected look of each patient before operation and the self-confident poise of each cured case.

CONGENITAL SYPHILITIC EPIPHYSITIS IN ADOLESCENCE

BY E. J. GAENSLEN, M. D., F. A. C. S. AND WM. THALHIMER, M. D.,
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This condition is usually described as occurring only during the first months of infancy. Whether congenital syphilitic lesions of any description may occur later in childhood, particularly in adolescence, when there have been no symptoms of syphilis in early life, is regarded by some writers as a contested point. The statement will probably go unchallenged that many cases of bone and joint syphilis are not recognized. Wile of Ann Arbor believes that many cases of syphilis are mistaken for tuberculosis and subjected to operation.

The great difference of opinion as to the frequency of syphilitic bone and joint lesions is in itself an indication that our knowledge of the subject is still very incomplete. Every addition to the literature, therefore, throwing light on the problems involved would appear to be in order. The following case of congenital syphilitic epiphysitis in adolesence is reported because of the difficulty in diagnosis and because of the opportunity afforded for study of the pathology of the lesion.

In July, 1918, a white male age 13, presented himself complaining of pain in the region of the left hip and lameness following a fall while roller-skating. An abstract of the records is as follows: Family and personal history negative except for a mild febrile attack three months previously, with pain in the left lower extremity. Examination showed moderate weakness in muscles of entire left thigh and leg with left foot in slight equinus. There was also moderate atrophy, circumference of thigh and leg being one-half inch less than of normal right. The left leg was one half inch shorter than the right. Both knee and ankle reflexes were absent. These findings were regarded as evidence of a previous mild attack of infantile paralysis. The weakness in the thigh and leg was very decided, more than would be accounted for by the slight atrophy. It gave a distinct impression of paralysis. It must be admitted, however, that while the weakness was perhaps more marked in

the quadriceps extensor and anterior leg muscles, as shown by slight foot drop, it was more generalized than that seen in the usual type of infantile paralysis. The one-half inch shortening in the leg could not well be regarded as the result of so mild and so recent an attack, and was considered a peculiarity rather than an abnormality. The condition was, therefore, regarded as infantile paralysis, and usual measures instituted for restoration of muscle power. Gradual improvement followed without other treatment, but the patient's general condition remained rather below par. No X-rays were taken at this time. One year later the patient returned with pain in the left hip and slight general indisposition. Examination showed tenderness over the left trochanter, slight limitation of motion in flexion, rotation inward and outward, other hip motions remaining normal. Temperature ranged between 99 and 100. Examination otherwise entirely negative. X-rays taken at this time, July 1919, showed the trochanter rather flattened with diffuse areas of rarefaction scattered throughout it and the adjacent portion of the femoral shaft. The epiphyseal line could not be made out, though it was still visible on the sound side. There was slight evidence of periosteal thickening of the shaft below the trochanter. Wassermann test was negative. Blood count was as follows:

Leucocytes	10,000
Erythrocytes	5,070,000
Hemoglogin	85%
Small Lymphocytes	22
Large Lymphocytes	8
Polymorphonuclears	64
Polymorph. Eosinophiles	2
Transitionals	4

Based on clinical and X-ray findings a diagnosis of some low-grade infection still confined to the trochanter was made and operation advised to avoid extension to the joint.

On July 29, 1919, an incision was made over the trochanter, the latter cut through with broad chisel and reflected upward. The cut section of the bone presented a very interesting and unusual appearance.

The cancellous bone appeared to be fairly normal, but scattered throughout the section were large and small irregular areas

of cartilage. The nature of the condition was entirely obscure, but tuberculosis or low-grade pyogenic infection was at once excluded. A liberal section was removed for study, and the cartilaginous areas were removed with curette and the trochanter sutured back in place and wound closed. A large plaster spica was applied. Bacteriological cultures from the bone chips removed were negative.

Wound healing proceeded normally, but patient was rather restless, and sleep was more or less disturbed in spite of adequate fixation. Temperature continued between 99 and 100 for several

FIG. 1. Thickened Periosteum, showing obliterating endarteritis in two arteries.

weeks, then returned to normal, the patient's general condition improved. The hip motions in the course of several months returned to practically normal. The pathological findings, gross and microscopic, did not help to clear the situation at the time. It was not until a return of previous symptoms about eight months later that further study of the case, especially of the later X-rays, made the diagnosis of syphilis convincing. A second Wassermann test at Columbia Hospital proved to be 4 plus. The previous test was

made outside the Hospital. On further inquiry a history of syphilis in the father several years before patient's birth was obtained, also a history of several miscarriages in the mother.

It is interesting from the standpoint of diagnosis that a report of this case and submission of microscopic slides to two pathologists of national reputation did not help us to make the diagnosis in this case. The points which did assist in finally discovering the nature of the lesion were the periosteal thickening along the shaft of the femur, the recurrence of symptoms in three

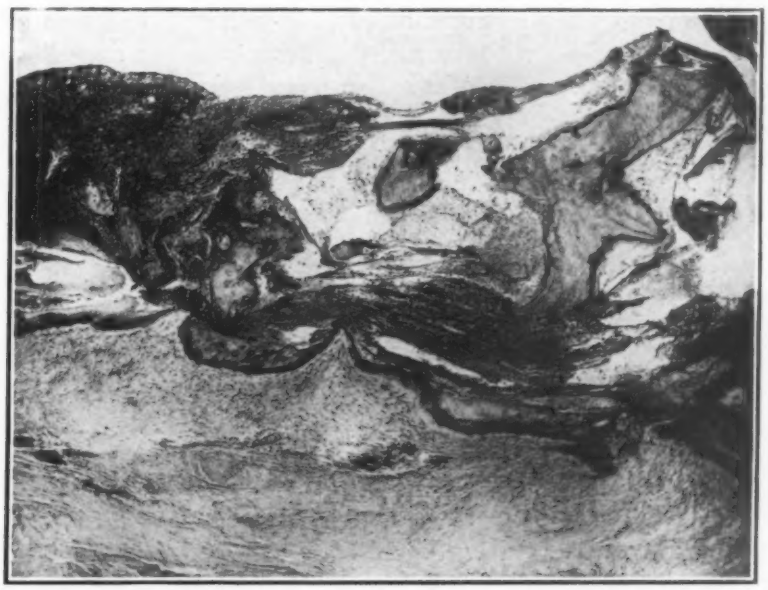

FIG. 2. Thickened Periosteum, and irregular subperiosteal cortical bone.

more or less definite attacks during the 15 months the patient was under observation, the restlessness at night in spite of adequate fixation, and lastly the prompt and complete disappearance of pain on placing patient on anti-syphilitic treatment.

In the light of the later findings in this case there may be a legitimate question as to the correctness in assuming a mild attack of infantile paralysis to explain the weakness and atrophy in thigh and leg as well as the slight foot drop and absent knee reflexes. Parrot has described a syphilitic pseudoparalysis associ-

ated with severe epiphysitis and separation of epiphysis. Whether milder grades of syphilitic epiphysitis may be associated with symptoms simulating paralysis the writers were unable to determine from the literature.

Gross Description

Specimen consists of 7 or 8 large and small pieces of bone which are flattened and have rather smooth surfaces as though removed by a chisel. They vary in size, the largest measuring about .2 by .5 cm. by 2 cm. A few of them are covered by periosteum, and some of them, at one edge, show fairly firm cortical bone, 2 or 3 mm. in thickness. The remainder is cancellous in structure. This cancellous structure, however, is not made up

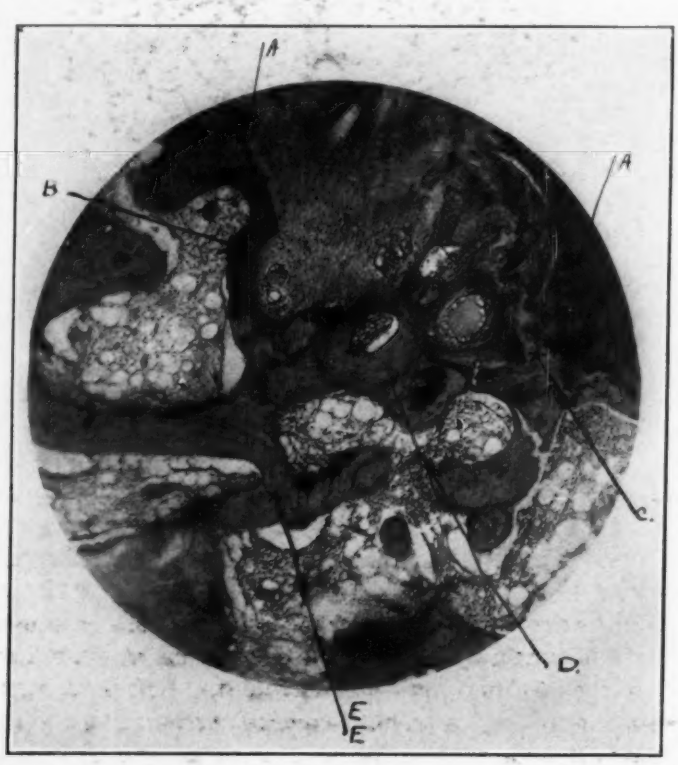

Fig. 3.—Riotous admixture of (A) cartilage; (B) excessive degree of calcareous deposit in cartilage; (C) osteogenesis; (D) new formed bone, and (E) old bone.

entirely of bone, and is even more irregular than ordinary cancellous bone. Scattered throughout the cancellous bone is a very irregular architecture of smooth glistening material which has the gross appearance of cartilage. In places this is accumulated into fairly large areas about a centimeter in width and somewhat more than a cm. in length. These accumulations, however, are not isolated, but have ramifying from them strands of similar glistening material, all of which form a most irregular inter-lacing and sponge-like net work, so that there is at least as much, if not more, of this cartilage-like tissue present than there is cancellous bone.

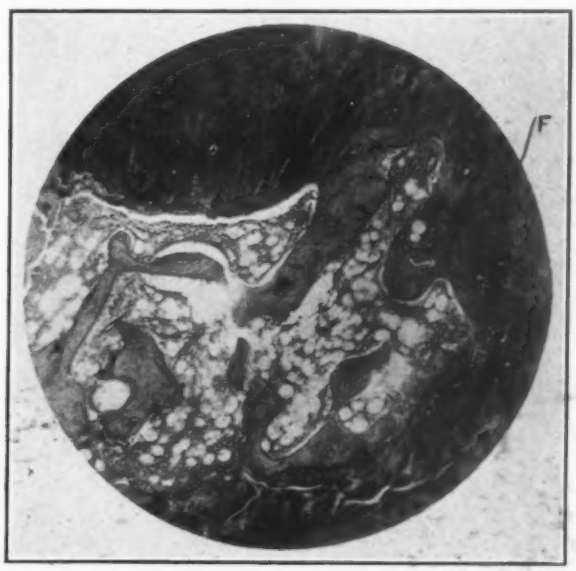

FIG. 4. Riotous admixture of cartilage, and bone at an irregular situation of osteogenesis, with attempt at epiphyseal line formation at (F).

MICROSCOPICAL DESCRIPTION

Many sections were cut from the various fragments and stained by hemotoxylin and eosin and iron hemotoxylin and eosin. The sections show the various constituents of bone growth at an epiphyseal line, but the various elements are extremely irregularly placed, showing none of the regular arrangement of these tissues, as found in a normal epiphyseal line where bone growth is occurring. The amount of cartilage present is about twice as much as that of

bone. All the cartilage is hyaline in type with all of the characteristics of very young cartilage such as is found in embryonic cartilaginous bones. The cartilage cells are extremely irregular in their distribution, some of them close together, some of them far apart. They are also most irregular in size, varying from very small ones to extremely large ones. All of the cartilaginous areas are in contact with young cancellous bone, and in the midst of some of the large areas of cartilage are what appear to be islands of young, actively growing bone. This appearance of islands may be caused by

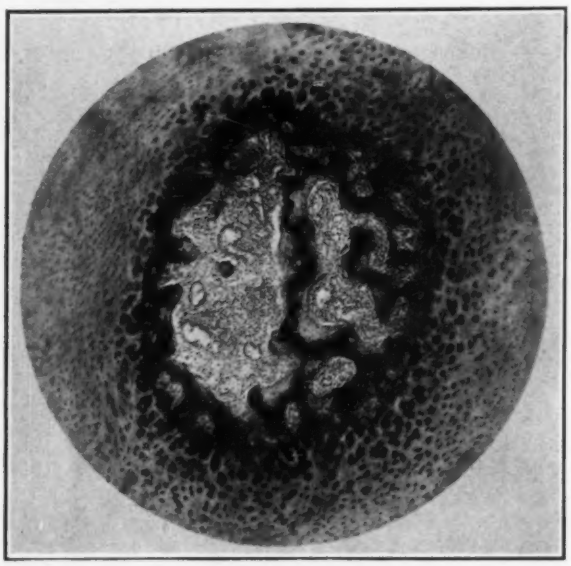

FIG. 5. Island of bone developing in midst of fairly normal cartilage.

strands of growing bone having been cut at right angles. The bony trabeculae are more irregular and tortuous than in normal cancellous bone and are made up entirely of young bone, as determined by the size and staining reaction of the lacunar cells and surrounding bone matrix. The bone, however, does not appear to be all of the same age. In the central parts of the trabeculae there is in some places an imperfect lamellar arrangement, the lacunar cells being smaller and more regular in relationship to one another and the bone matrix has more of the staining reaction of adult bone. Most of the trabeculae, however, show at their periphery a covering of clear-cut and apparently actively growing osteoblasts, some-

times piled up into several layers. Between the osteoblasts and the more completely developed bone is found in most situations extremely young bone with large lacunar cells very irregularly arranged in the matrix, which is somewhat blue staining, in contradistinction to the pink staining of the more adult bone. At many such situations there is present in the adjacent cartilage a greater amount of calcarous deposit than in normal cartilage undergoing ossification. At great numbers of situations, where new bone is being laid down, along the edge of cartilage, or within an area of

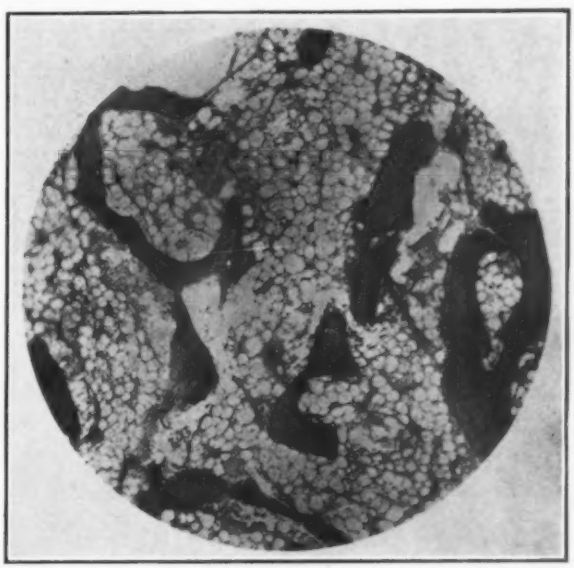

FIG. 6. Slightly atypical cancellous bone with large marrow spaces.

cartilage, there is found the picture of normal transition of cartilage into bone formation. In many places this similarity is so exact that the cartilage cells are found lined up in front of the area of bone growth to exactly duplicate the arrangement of cartilage in an epiphyseal line. The cartilage cells here are arranged in columns vertical to the advancing line of bone growth and are also much larger than normal cartilage cells. The trabeculae of bone in their irregular arrangement circumscribe large and small irregular areas. These areas correspond to marrow spaces and contain all of the usual constituents of true marrow. The structure of this marrow, however, is not the same in all spaces. In some

spaces it is extremely cellular, the cells being those of hematopoietic marrow. In other spaces it is mainly fatty marrow and there are spaces showing all grades of admixture of these two. In some spaces connective tissue stroma is much more prominent than in normal marrow, although in no space is it sufficiently prominent or old to be considered an area of fibrosis. As mentioned above, most of the trabeculae are covered by a layer of cells which in some places are several cells in thickness, made up of typical osteoclasts. At no place is dead bone found, that is, bone with empty lacunar

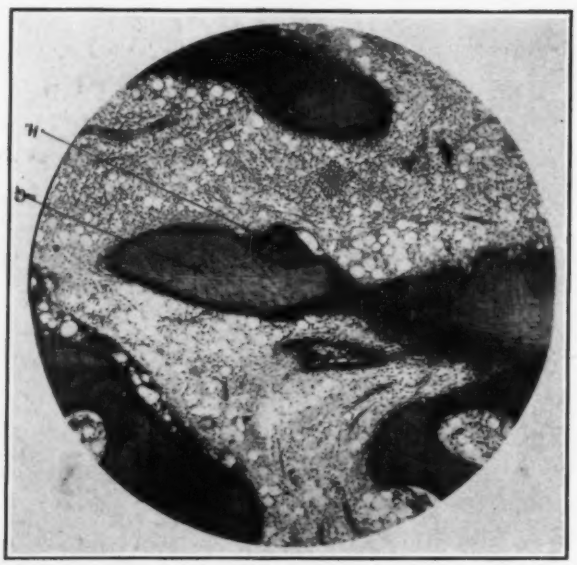

FIG. 7. Trabeculae of bone with well formed (old) bone at center (G); and very young bone at periphery (H).

spaces, and also, at no place is found definite bone absorption by means of osteoclasts, although certain areas are suggestive of this.

One section was made of a fragment covered by periosteum. The periosteum shows a marked degree of thickening and the structure is much denser than normal. Many blood vessels are present and a moderate number of them show a marked thickening of the walls, especially of the intima, amounting in some almost to a completely obliterating endarteritis. The surface in contact with bone is very irregular. The bone which is present here is not a thick layer of dense cortical bone but is made up of irregular narrow pieces of

trabeculae. The bone immediately in contact with the periosteum is young bone but in places shades rather abruptly into older bone. Trabeculae of bone are next found a short distance away from the periosteum, some of which are made up practically entirely of young bone, others of older bone at the center and young bone of the periphery. In the center of some of these trabeculae are found irregular areas of what looks like degenerating bone.

DISCUSSION OF THE PATHOLOGICAL FINDINGS

This lesion in the greater trochanter of the femur we believe to be a manifestation of congenital syphilis. The findings on which we base this opinion are as follows:

1. The predominance of cartilage and the riotous appearance of the process of osteogenesis.
2. The lack of completion of bone formation.
3. The excess of calcium deposit in the cartilage which is in apposition with the areas of bone formation.
4. The obliterating endarteritis in the thickened periosteum.

Stains for spirochetae could not be made because the process of decalcification which was necessary prevented the use of methods for staining spirochetae.

It is believed that the lesion reported corresponds to descriptions of epiphyseal lesions of congenital syphilis given in the literature, such as in Kaufman's Text Book of Special Pathology. The lesions described there were present in the new born and in infants. So far as we know this lesion has never been described in older individuals.

CRITICAL COMMENTS ON A PAPER ENTITLED "ASTRAGALECTOMY IN PARALYTIC FEET"

BY ROYAL WHITMAN, M. D., NEW YORK

To the Editor:

I have read with much interest Dr. Sever's paper entitled, "Removal of the Astragalus in Paralytic Feet†." As I was absent when the paper was presented at the last meeting of The Orthopaedic Association, these remarks may be considered as a belated contribution to the discussion.

Astragalectomy and backward displacement of the foot is first recorded in the report of The Hospital for the Ruptured and Crippled for 1897. Since then more than 1,000 of the operations have been performed at this institution. The opportunity therefore, for observation of late results and for analysis of the factors that determine relative success or failure has been exceptional.

The operation was originally designed for paralytic calcaneus, of advanced degree, often combined with valgus. The transplantation of the peroneal muscles to the tendo Achillis was indicated therefore, to remove a distorting force and to supply a direct pull upon the depressed heel. In this class it is of functional value, but in the less advanced cases in childhood, the transplantation is omitted because it predisposes to inversion of the foot. The latest application of the operation is in the treatment of young children, as soon as the diagnosis of irreparable paralysis of the calf muscle is established, in order to check the rapid and progressive atrophy of the foot, by restoring the resistance necessary for normal locomotion.

The operation is based on pure mechanics and if it is properly performed, the result, in older subjects, whose tissues are stable, is practically assured.

In the treatment of young children, however, supervision is of great importance, particularly the adjustment of the shoe. In

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†Dr. J. W. Sever, Boston, Journal of the American Medical Association, Oct. 30, 1920.

The paper referred to is similar to but not the same as that read at the American Orthopedic Association.—Editor.

some cases there is a tendency toward varus, especially if the deformity was originally of this type. It is caused usually by the unbalanced action of the tibialis anticus or posticus, so that transplantation of one or both muscles may be required to supplement the original procedure.

In recent years the operation has been applied to other forms of paralytic deformity, even for equinus, as illustrated by Dr. Sever's report. I have found it most serviceable in re-establishing stability, particularly resistance to dorsal flexion, thus enabling the patient to lock the knee, as an essential to effective transplantation of the biceps, and in the larger class of extreme and extensive paralysis of the lower extremities in which deformities of the feet are the chief cause of the discomforts of brace wearing.

In this broader application, the degree of relative success can be estimated only by its effects in carrying out the particular purpose for which it was undertaken.

Dr. Sever makes one statement with which I most emphatically disagree. "No preoperative condition, so far as deformity is concerned, can determine what the postoperative condition is likely to be."

As has been stated this operation is based on simple mechanics. By removal of the astragalus, one removes the center of lateral motion and lateral instability. By displacing the foot backward, one reduces adverse leverage and implants the malleoli on its basic structure, so that dorsal flexion may be checked by impact of the scaphoid with the tibia. If unbalanced muscles tend to induce deformity, they are transplanted as a supplementary part of the operation.

Movement is controlled except in plantar flexion. Thus the deformity "likely" to occur is equinus and if this is not restrained, the tendency of the dependent foot is toward varus.

In older subjects a moderate degree of equinus, in compensation for a shortened limb is not necessarily undesirable, if a properly balanced shoe, which equalizes pressure on the sole can be provided. But in childhood this tendency should be checked by methodical daily stretching, in which the parents are instructed.

I would here emphasize the point that the "Whitman" operation was designed for paralytic calcaneus, for which in my opinion it is the only effective remedy.

From this standpoint Dr. Sever's material may be examined:

There were 207 operations, of which but 52 were for deformities of the calcaneus type. In 91 cases, the deformity was simple equinus or in combination with lateral deformity, and in 69 of these the Gastrocnemius muscle was in fair or good condition. In 29 the case was one of varus or valgus, and in 15 the foot was flail.

But 80 of the total number of cases appear in the table of "Comparison of preoperative and postoperative deformity."

23 were of the calcaneus type and in 10 of these there was recurrence of the original deformity. Thus in 45% of the cases, failure was complete and it may be ascribed with certainty to insufficient backward displacement of the foot. In 6 of the remainder, varus was present, which implies partial failure. This in my experience is explained either by imperfect operative technique or by unbalanced muscular action indicating transplantation, or by neglect of after care.

Dr. Sever refers to stiff feet, as if stiffness were a characteristic effect of the operation and it appears that in 52 cases there was practical fixation at the ankle joint.

The purpose of the operation, as performed for calcaneus, is to restore lateral stability and to check dorsal flexion at a right angle, but a range of plantar flexion of from 10 to 20 degrees is retained. This is of great advantage since it permits an elevation of the heel in compensation for shortening, and directs the weight forward, thus stimulating the development of the atrophied fore foot.

If there is a tendency toward varus, it is checked by thickening the outer border of the sole and heel of the shoe and by methodical manipulation. If greater restraint of the ankle motion is desired as for flail foot a groove may be cut at the calcaneo cuboid junction in which the denuded malleolus is embedded. But, "stiff ankles" are, in my experience, rare.

I shall not attempt to analyze the miscellaneous cases presented in the paper for obvious reasons. With some of Dr. Severs'

conclusions I can agree, for example that the extent and distribution of the paralysis must necessarily limit the usefulness of a local operation. And, that astragalectomy is rarely indicated for simple varus or valgus, at least, as a primary operation. I should suggest also that one should not apply this operation in the treatment of equinus with an active gastrocnemius muscle, except for the purpose of restraining lateral distortion when it is proposed to utilize plantar flexion to compensate for a shortened limb; for unless it is prevented, the recurrence of equinus is not "likely" but certain.

There is a practical consideration which is of great importance in the more general application of the operation, namely, that older patients whenever possible, discard apparatus irrespective of its aesthetic influence on the gait. For the attainment of this ambition a stable foot is the primary essential.

In the first decade of its history, the operation, in its limited application, was performed almost exclusively by myself, but during the last five years the yearly average has been approximately 100, performed for a variety of conditions, and by many surgeons, including House Officers. The observation of the results of this more general application of the operation shows that they vary in fair proportion with the experience and skill of the operator.

I conclude therefore, that success is determined

1. By the selection of cases, in the sense that the purpose of the operation is clearly defined; whether it be to free the patient from support, or merely to lessen his burden and discomforts.

2. By the understanding of the mechanical principles on which the operation is based, and by exactitude of operative technique in applying them.

3. By appreciation of the type of recurrent deformity to which the character of the paralytic disability predisposes and of the means by which it may be checked or remedied in its inception, which implies of course, efficient after care.

In each of these particulars the treatment at the Children's Hospital, as described by Dr. Sever, as far as one may judge from the report, in the light of one's own experience, leaves much to be desired.

It may be that an operation designed for paralysis of the gastrocnemius is often indicated even when this muscle is active,

as in the 69 cases (33% of the entire number) recorded but such a novel application of the procedure should receive separate analysis. Furthermore, cases in which because of defective technique, the principles of the operation have not been applied should be excluded from consideration altogether. From the scientific standpoint the chief value of such investigations is to bring to light errors of omission and commission that may be avoided in the future by those who made them. I cannot agree therefore with Dr. Sever, that "we may well rest content with these results until similar figures and results are available for comparison." How can the surgeons of The Children's Hospital rest content when their records state that in 15 of the 54 cases in which a note is made, the backward displacement of the foot was insufficient, and when the statistics indicate clearly that in the treatment of calcaneus this percentage of admitted error was far exceeded?

As the originator of this operation, and indirectly responsible therefore, for the results, I feel that it is my duty to offer this, which I trust may be considered constructive criticism.

THE TREATMENT OF FRACTURES

BY H. WINNETT ORR, M. D., F. A. C. S., LINCOLN, NEBRASKA

Read before the Annual Meeting American Orthopedic Association, Toronto, Canada.

Our methods for the treatment of fractures show a marked recent tendency toward further demoralization by the popularization of methods which in reality or by implication shorten the period or impair the efficiency of immobilization.

In the time of Mr. Abernethy, a hundred years ago, fractures of the femur, especially of the neck, were considered to be treated in a satisfactory manner if the patient were kept upon his injured side in a feather-bed. If non-union followed, Mr. Abernethy said, "The people will say we did everything we possibly could have done, and that it was the nature of the case never to get well."

Since that time many expedients of treatment and various kinds of apparatus have been placed before the profession for the treatment of leg and femur fractures. It is in an effort to arrive at some conclusions regarding the value of these methods and devices that the following paper is presented.

In a statistical table of fractures in the London hospitals for thirty five years femur and leg fractures constituted more than half of all hospital fracture cases. In the American Text Book of Surgery published in 1894, the statement is made that the reduction of fractures "should be made as completely and as promptly as circumstances will permit, having regard to the condition of the patient and of the limb. If there are severe associated injuries and the shock is great, it is well to wait for reaction, and meanwhile to immobilize the parts in partial reduction with simple dressings; if the limb is greatly swollen it may be impossible to restore it to its full length without causing dangerous pressure. An anaesthetic may be required to overcome the opposition of the muscles; and in the case of a fracture near to or involving a joint, anesthesia is doubly valuable, both to recognize the details of the fracture and to facilitate the complete and accurate readjustment of the parts."

For dressings, the above text-book objects to any circular bandages being employed. It suggests wooden splints for lateral support and recommends fracture boxes, Volkman's splint, wire gauze, moulded splints, plaster of Paris, Buck's extension, Smith's anterior splint, Hodgen's splint, and various modifications of these

devices. Under the heading of delayed or non-union this text book speaks as follows:

"A gratifying number of successes in fractures of the leg and thigh have been obtained by the use of orthopedic splints. In a number of cases of delayed union of the leg, union has gradually become complete while the patient was using the limb under the protection of a suitable splint; it is thought that the slight irritation caused by bearing the weight upon the limb favors ossification."

Bone transplantation and metal plates had not been introduced and amputation was suggested to rid the patient of a useless extremity in which non-union had occurred.

In "Surgical Diseases of Children" by Samuel W. Kelly, 1914, fracture of the shaft of the femur is treated by "Bandaging the thighs together with a folded towel between the knees or straight strips of binder's board applied around the limb and retained by adhesive straps and a bandage." It is said, also, that "perfect results are also obtained by simple straight splints from the waist to the ankle."

While it is true that such perfect results have been obtained, one knows that many of the deformities in legs and thighs of older children are due to just such careless methods in the treatment of fracture in infants and young children. Dr. Kelly, in this book, in one sentence, says that, "Binder's board or a whittled wooden splint may be used in fracture of the leg;' and then in the next sentence that "Ready-made splints seldom fit." The latter teaching is excellent.

One of the points which it is desired to emphasize in this paper is that in general, similar methods should be used for fractures in children as in adults. At any rate the same principles must be observed.

In one of the more recent works, "Medical and Surgical Therapy" edited by Sir Alfred Keogh and published by D. Appleton and Co. there are extensive articles on fractures presumed to record our conclusions from the fracture surgery of the war. This volume, which will probably be extensively used represents practically only the conclusions of the French.

Personally the writer of this paper finds much in the writings of Dr. Leriche with which to agree. Unfortunately, however, the

plaster of Paris technique—almost his sole resort—will be understood by but few and will confuse many.

There is one excellent feature in the work of Dr. Leriche. He adopts plaster of Paris and discusses no other forms of mechanical treatment or apparatus. Mechanical principles demanding restoration of normal relationships and immobilization are complied with but only by the use of plaster of Paris as a fixative.

In observing patients in which attempts to secure similar results have been made with the ordinary splints, especially the ready-made splints, with either weight and pully traction or no traction at all, one must conclude that only those fairly accurate in the use of plaster of Paris should attempt to follow the teachings of Leriche.

A recent text book evincing unusual care is that of Warbasse, published by Saunders and Co. The first of the three volumes is devoted largely to diseases of bones and joints. The article on fractures remarks by way of preface, "The immediate treatment of fractures is based upon two fundamental principles—the correction of deformity and the holding of the fragments in normal apposition until they grow together."

Warbasse expands in detail upon the methods for immediate reduction and fixation. He says that plaster of Paris is the most valuable of the materials used for splinting. There is a careful description of plaster of Paris technique (pp. 477-478) and much could be gained by combining his work with that of Leriche for application to the treatment of all fractures. Unfortunately Warbasse falls into the common error of proceeding directly from this most useful of all methods to various others less easy to understand and more difficult to use. Various wire frame and suspension devices are described going as far back as to the time of Volkman.

The writer of this paper is willing to go so far as to say that as a matter of practice it is quite wrong to teach any longer the methods of treatment for leg and thigh fractures as given by Warbasse on pages 486-7, 490, 491, -2, -4, -9, and 500.

From hundreds of observations upon these and various other modifications of such treatment it has been emphatically shown that neither immobilization nor satisfactory traction can regularly be obtained by these methods. To copy these methods from one

text book to another as has been done for a number of years is to carry into the whole treatment of fractures an amount of confusion which leads not only to a lack of standard methods of treatment but to a failure to secure anything like a uniformly high standard in the way of results.

The Thomas hip splint which should be used in nearly all fractures of the leg and femur is not described in Warbasse's book at all. The Thomas splint described by him on page 586 is a posterior hip splint which is not a traction splint at all and one which applies to joint conditions or to the late treatment of fractures only.

Without unduly prolonging this paper by further argument, the writer wishes to put down these following conclusions which he believes to be fully justified by the military hospital experience of the recent war.

First, There are two agencies of major importance in the treatment of fracture of the femur and the leg. These are the Thomas splint and plaster of Paris.

Second, The less the Thomas splint is modified the more efficient it is.

Third, For fracture of the neck of the femur, as shown by Dr. Whitman, and for fracture of the leg below the knee, either open or closed, plaster of Paris is usually indicated.

Fourth, For fracture of the shaft of the femur the Thomas traction splint has shown itself to be far more useful both as an emergency splint and a splint for continuous treatment than any or all other mechanical devices heretofore recommended for the purpose.

Fifth, Skeletal traction for fracture at the extreme lower end of either the femur or leg is a justifiable addition to the Thomas splint.

Sixth, The Balkan frame and, in a few instances the Hodgen splint may be applied in extensive compound injuries to the thigh.

Seventh, Mole-skin plaster or adhesive glue must be used for traction. This is better because it is intrinsic in the Thomas splint. In addition to this, elevation of the foot of the bed with the splint anchored at the lower end contributes to the traction and simplifies the wearing of the ring splint.

Eighth, Elimination of Buck's extension, Hodgen's splint, weight and pulley traction, the Ruth Maxwell method, Volkman's

sliding splint, the Liston splint, and similar and related methods from our text books would hasten the day of general adoption of the Thomas splint and tend toward the rapid improvement in efficiency of treatment and the character of results in fracture of the thigh and leg.

The attempt to provide numerous methods of splinting results in the present state of things, that it is the rare surgeon who is really proficient in the use of one. From having seen thousands of splinted fractures by many surgeons I can say that real immobilization of a fracture in a splint is seen only occasionally. And it is in this connection that I desire to make the principal point of my paper.

Stiff joints and limited motion have regularly been blamed upon too thorough and too prolonged immobilization. If this were criticism of a method we might allow it to pass. It is however, in fact, an attempt to contradict the fundamental truth that rest is essential to healing. My own opinion is that the stiffness, excess callus, adhesions and ankylosis are all due to failure to adequately immobilize. Ideal immobilization from the beginning, would, I believe, regularly give us healing of joint injuries with a minimum of joint damage and with therefore, a minimum of ankylosis.

Bony ankylosis of a joint is of course the result of joint pathology and quite as certainly any really damaged joint is further damaged by irritative movement before healing has occurred. Careful distinction must therefore, be made between an inflammatory joint condition without destruction of the articular surface in which a joint may be moved and all other joint conditions in which with a different pathology a joint may be kept moving for a time but only at the expense of further injury and more certain subsequent bony fixation.

I desire to comment finally upon the mobile joints exhibited so proudly as a result of early movement in fractures near the knee. It is my opinion that such knees treated by the method of Major Pearson and others move so well not because of early motion but in spite of it. The secret of the success of the method I believe, lies in the excellent splinting which secures, even with a moving knee, such good position and such perfect fixation of the fracture fragments. Certainly one sees regularly serious deformities and complete ankylosis in patients in whom with persistent efforts at knee motion the fracture itself has not been controlled.

News Notes

The Orthopædic hospital under construction at Gastonia, North Carolina, will be completed and ready for occupancy early in 1921.

It is announced that Grove Park Inn at Asheville, North Carolina, will henceforth devote all profits to the establishment and maintenance of a hospital school for crippled children.

Drs. Theodore C. Lyster, Eugene R. Lewis and Isaac H. Jones announce their offices at 1920 Orange Street, near Westlake Los Angeles.

Dr. John W. O'Meara is in practice in orthopædic surgery at 3 Linden Street, Worcester, Mass.

At a meeting held December 3, 1920, the Pittsburgh Orthopædic Club was inaugurated with the following officers: Dr. Stewart L. McCurdy, President; Dr. David Silver, Vice President; Dr. Eben W. Fiske, Secretary. Monthly meetings will be held.

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Current Orthopaedic Literature

LATE RICKETS AND ITS RELATION TO CHRONIC DISEASES (Genu valgum and varum, Coxa valga and vara Osteochondritis coxae, Schlatter's disease, Pes planovalgus and kyphoscoliosis). By A. Fromme, *Bruns Beitraege z. klin. Chirurgie.* Bd 118. Heft 3. Seite 493. 1920.

The article is the result of investigation upon 103 cases in the Surgical clinic of the Univ. of Goettingen. The chief complaint was pain, especially in the knees and feet. Among the objective findings were predominant: Hypertrophy of the epiphyseal junction and flatfoot. The gait was unsteady apparently the result of muscular weakness. Tenderness on pressure upon the bones and in several instances metaphyseal enlargement which suggested Barlow's disease. The X-ray always revealed typical rachitic changes in the epiphysis and presented at times spontaneous fractures.

The author explains the development of these deformities on the basis of a continuous trauma acting upon the zone of growth, i. e. the epiphysis. Genu valgum, Coxa vara and valga have developed from the simultaneous action of body weight and muscle pull; osteochondritis coxae or Perthes disease results from weight bearing upon the newly formed bone under the articular cartilage; Schlatter's disease is the sequence of pull of the Quadriceps upon the tibial tubercle. In all cases the rachitic changes have altered the inherent strength of bone and epiphysis. Late rachitis is much more prevalent than commonly supposed. Therapeutically is advised a careful bloodless reduction of the deformity and general treatment.—*A. Gottlieb, San Francisco, Calif.*

SOME DIFFICULTIES IN THE DIAGNOSIS OF OSTEOSARCOMA. By Robt. B. Cofield, M. D., Cincinnati. *Jour. A. M. A.*, Vol. 75, No. 19, Nov. 6, 1920.

As osteosarcoma's primary origin is in the medulla or the periosteum of bone, as it is not confined to any particular age in life, and as it not infrequently runs an irregular clinical course on account of the wide variation in its histological elements, its early recognization is extremely difficult. The fact that a deferred diagnosis not infrequently means the sacrifice of the patient's life, while a mistaken diagnosis may result in the needless loss of the patient's limb, brings to us the realization of the importance of a careful study of this problem.

Since there are no pathognomonic symptoms or definite serologic reactions whereby we can recognize the early appearance of primary osteosarcoma, we are compelled to rely for a diagnosis on: (1) the clinical data; (2) roentgen-ray examinations, and (3) exploratory operation with macroscopic and microscopic examination of the pathological material.

The clinical course of osteosarcoma varies according to its origin and degree of malignancy, and whether it is of the medullary or periosteal variety. Medullary sarcoma appears in the long bones usually has its origin in the region of the metaphysis, and soon takes on a rapid destructive effect, invading the shaft and breaking thru the cortex, where it is prone to involve the surrounding tissues; the epiphyseal and joint cartilages are the most resistant barriers to its invasion. Pain, of a severe, boring character, is often the first indication of its presence; and on account of its proximity to the joint and the accompanying effusion which may appear in the articulation, the condition is often mistaken at first for an arthritis. Since the pain is neither increased nor relieved by fixation, the arthritis involvement can usually be ruled out. An irregular temperature with elevation to 99 or 100 F. occurs, especially in the rapid growing form. A leukocytosis may be present to some extent and some authorities believe that an eosinophilia is a sign of value in the diagnosis of this variety. The Bence-Jones protein reaction in the urine may be present. Since metastasis is disseminated thru the blood stream, involvement of the lymphatic glands does not occur until late in the disease, with the possible exception of melanotic sarcoma. Metastatic deposits in the lungs may occur producing an irritating cough and the characteristic oval sarcomatous areas depicted in the roentgenogram. Decalcifacation of bone at the seat of the lesion may result in a spontaneous fracture. The rapid growth of the neoplasm and the infiltration of the surrounding tissues cause pressure on the deep veins, resulting in an engorgement of the venous circulation in the overlying skin. Cachexia soon develops, the patient rapidly looses weight and life is rarely prolonged longer than two years, in inoperable cases.

Sarcoma of the spine is usually of the medullary variety and most frequently involves first the bodies of the vertebrae. The clinical characteristics are similar to those occurring elsewhere in the osseous system, with the exception that here we soon encounter the formation of a gibbus from the crushing of the vertebral bodies by the superincumbent weight, and the rapid development of a paraplegia from the destructive invasion of the spinal cord. The examination of the spinal fluid may give a positive reaction in Lange's gold test and the yellow color of the fluid may suggest the presence of a malignancy.

The clinical picture of periosteal sarcoma varies but slightly from the myelogenous variety. The pain which the patient experiences is not of the severe boring character, but more of an ache; the tumor mass, being external to the shaft of the bone, is more easily recognized, and the early invasion of the continuous joint is more likely to occur.

The roentgen-ray picture of central sarcoma of the long bones is one of irregular destruction, with little or no tendency toward new bone formation until the periosteum is involved or broken thru. The lesion is usually confined to one area, although multiple lesions are occasionally observed. Medullary sarcoma in the beginning may be confused with myeloma, cyst and osteomyelitis. Since they frequently have the same point of origin and are more or less destructive in character, it may require repeated roentgen-ray examinations to differentiate these conditions. In myeloma, the globular outline of the tumor is maintained during its expansion; the swelling shows little or no tendency to extend along the shaft or break thru its capsule and invade the sur-

rounding tissues and, when completely removed does not recur or produce metastisis; myeloma was formerly classified as a nonmalignant giant cell sarcoma and is probably the same condition described by Barrie under the title "chronic hemorrhagic osteomyelitis." In cysts, the cell wall is usually sharply outlined and clearly defined, and shows no tendency toward rapid expansion and invasion.

In suppurative osteomyelitis the roentgen-ray findings are often not definite enough in the beginning to make a diagnosis; but as the disease progresses, the inflammatory redness of the skin appearing over the rapidly growing tumor would suggest a pus infection rather than malignancy.

Sarcoma involving the spine may portray an expansile tumor of the vertebrae simulating a circumscribed abscess when viewed in the anteroposterior position; and at the same time a lateral view may reveal the crushing of the vertebral bodies, as seen in Pott's disease. In other cases the extensive destructions of the vertebrae accompanied by more or less hyperplasia of bone, may resemble syphilitic spondylitis. The severe pain, which is not relieved by fixation, the rapid invasion of the surrounding tissues and the early involvement of the spinal cord, with a resulting paraplegia, strongly suggest malignancy.

The roentgen-ray picture of periosteal sarcoma is more distinctive in character, the new bone formation showing a trabeculation or spiculation at right angles with the shaft of the bone and presenting a smoky appearance. Early in its course it may be mistaken for osteoma, osteochondroma and myositis ossificans. Osteoma and exostoses are readily recognized, as they are conical or pedunculated, and their sharp outline is continuous with the bone from which they arise. Osteochondroma, when growing from the epiphysis laterally, gives a rather typical appearance; when of central origin it is more confusing. Either form may at any time take on the characteristics of malignancy, indicated by rapid growth and destruction of the enveloping capsule.

Myositis ossificans and ossifying hematoma, the latter occurring in subperiosteal hemorrhage from injury or scurvy, show a definite bony border due to the deposit of calcium salts, and the bone is laid down parallel to the shaft rather than perpendicular, as seen in periosteal sarcoma.

Clinical observations and roentgen-ray studies should not be continued over too long a time. When the clinical data and roentgen-ray examinations are not sufficiently distinctive to make a diagnosis an exploratory incision is justified. If the presence of malignancy is established, operative measures, unless they are contraindicated, should be carried out at once.—*Leo C. Donnelly, Detroit.*

REMOVAL OF THE ASTRAGULUS IN PARALYTIC FEET. RESULTS IN TWO HUNDRED AND SEVENTEEN CASES. By J. W. Sever, M. D., Boston. *Jour. A. M. A.*, Vol. 75, No. 18, Oct. 30, 1920.

It seems wise and of distinct value to present end-results from clinics or individual operators, regardless of the nature of the results. New procedures often lead to a stampede of operating by the advocated method, without knowl-

edge of end-results, and even old methods are often perpetuated indefinitely until one takes the trouble to see the end-results of such procedures, two, three, or five years later.

The main object of this operation is to restore the symmetry and stability of the foot following paralytic distortions or relaxations. This report covers 195 cases. The operation has been performed on 217 feet in these cases by eight different surgeons, on feet varying from those completely paralyzed to those in which only one muscle was weak or gone. The object in all cases was to restore either symmetry or stability. It has failed to do this in many cases.

It seemed a matter of interest and importance for any adequate study to determine the muscle power existing in these feet before operation.

Under the classification good to fair are those feet in which muscles were: (a) normal; (b) good: when the muscle was strong enough to overcome gravity and some resistance, but was not quite of normal strength; (c) fair: when the muscle was able to overcome gravity and could perform part of the normal movement; (d) poor: when slight movement could be accomplished but gravity could not be overcome, and (e) gone: totally paralyzed; no perceptible contraction.

The persistence of power in the toe flexor group, with weakness or complete loss of power in the other groups, especially the toe extensors and the peroneals, leads in many cases to a postoperative varus associated with equinus of greater degree than was planned for at the time of operation. This deformity is liable to increase and result in a foot no better than before, and in many cases worse than previous to operation. In the analysis of a large series of cases by Lovett, it has been shown that of all the foot muscles, the toe flexors are the least often involved and the least often totally paralyzed. The posterior tibial has played very little part in this deformity, for in connection with the anterior tibial, it has been the most frequently paralyzed, or affected to the point at which it could not function effectually. Even adequate backward displacement of the foot may lead to later troublesome varus with persistent toe flexion. It would be better to divide them at the time of operation, for they act in the same way as they do in congenital club-foot, and tend constantly to increase the varus and equinus deformity.

A foot, which, even if unstable at the ankle, allows weight bearing with the sole flat on the ground is, other things being equal, better than a foot with a more or less stiff ankle, with the forefoot in equinovarus, and weight bearing restricted to the ball of the foot or its outer border.

In a number of cases, transplantation of tendons has been made, namely, the peroneals have been carried forward and inserted into the mid-dorsum of the foot. In others, the peroneals have been divided and inserted into the os calcis after Whitman's method. The author sees no especial reason why they were disturbed at all. If the operation was devised to correct a hollow foot, in this series it has in many times failed to do so.

Originally devised as a practical operation for a calcaneovalgus deformity to insure stability, the operation has of late years been used more and more to insure lateral stability of the foot for all paralytic conditions. This is alright perhaps so far as the foot goes, but there are other considerations to be taken into account in walking and weight bearing besides the foot alone. Rarely

does one see in a given case, supposedly in need of astragalectomy, the foot and lower leg alone affected. Many times the trunk, abdominal, gluteal and thigh muscles are paralyzed in a greater or less degree, all, of course, affecting the gait and function. Many times the feet and ankles are the least factors, and not at all the principal elements in the lack of ability to walk.

An astragalectomy for a simple varus or valgus represented by a moderate lateral instability is not indicated. The indication is quite in the other direction in a flail foot, or a foot with only one muscle group left, in which there is persistent deformity in weight bearing, and inability to get the sole of the foot to the ground in weight bearing. With a complete flail leg and foot, the question is not at all clear that an increase shortening as a result of the removal of the astragalus, and a stiff ankle, are going to make very much actual difference in function, as a brace will always have to be worn.

On the basis of a limp alone, the major part of the limp may not be due to the foot condition, as may be noted in the study of any series of cases, but may be due to weakness of any of the leg, hip or abdominal muscles. Following astragalectomies, the limp is practically no better except in those cases who had such good muscle power before operation that the operation should never have been performed, and where the ankle motion is nearly as good as that seen in a normal foot. Loss of ankle motion as expressed in an inability to plantar flex, either due to paralysis of the gastrocnemius, or as a result of an operative procedure, gives the same end-results so far as a limp goes.

An analysis of the individual deformities before operation and after operation shows that any type of variation is possible and that no preoperative condition, so far as the deformity goes can determine what the postoperative one is likely to be.

As a result of this analysis of these cases, I feel that an astragalectomy is not an operation to be advised for any foot showing lateral instability as a result of the paralysis of one muscle group alone. The lateral instability of the ankle may be corrected, but more subsequent deformity may develop. It is as good an operation as any in feet that are flail, or those that have only one muscle group left. In the presence of toe flexors, varus is likely to develop later and lead to a bad weight-bearing position.

The best results were in feet that had good muscle power before operation, and where after operation there was good motion between the tibia and the os calcis, and good weight-bearing position of the foot. In the latter cases, the author believes that it never should have been performed. It is not an operation that will cure a limp or even improve one as a rule.

It is not an operation to be advised lightly or invariably for foot deformities, but should be performed on older children in selected cases.—*Leo C. Donnelly, Detroit.*

RIB GRAFTING OPERATIONS FOR THE REPAIR OF BONE DEFECTS AND THEIR END-RESULTS AT LETTERMAN GENERAL HOSPITAL. L. Eloesser. *Arch. Surg.*, 1920, lxxii, 428.

In bone grafting operations, the author selects the ribs as furnishing the best material for bone transplants. It was believed than a thin, highly viable, vascular graft, with soft cortex and a large amount of cancellous tissue produces

better results than a bone with thick, dense cortex and little or no cancellous tissue. Absorption of osseous tissue and deposits of permanent bone take place more rapidly in such a graft, thus permitting an earlier return of function to the limb.

Gallie states that the processes of absorption outstrip those of replacement and therefore cancellous bone, such as rib, should not be used when the graft is to be placed under strain or when the gap to be bridged is wide and rapid absorption is not desired.

The author's series seems to show that the very tardiness with which massive grafts are absorbed is a distinct advantage inasmuch as a thin, frail graft may be absorbed before the osteoblasts are prepared to lay their bony deposits on it.

The practical advantages of the rib graft consist in the unlimited supply, its easy accessibility, its comparative tubular strength, its viability, and the short postoperative stay in bed.

The technic of rib-grafting is not difficult being essentially the same as for any other graft. The front part of the fifth or sixth ribs is usually selected, as it is straightest. The rib is removed with its periosteum without opening the pleura, which although not dangerous, is best avoided. The rib is carefully dissected away from the muscles and pleura for one or two inches; it can then be snipped off by a curbed rib shears. The cut end is retracted outwards and the intercostal muscular attachment dissected as far back as necessary. A hole is then drilled through each end of the excised rib and the graft split longitudinally with an osteotome or stout knife. Kangaroo tendons are threaded through the holes in the graft and through the previously drilled holes in the ends of the fractures; they are then threaded around the entire bone with a ligature carrier tied securely. The split portions of the graft form a trough in which lie the ends of the fractured bone. The periosteum is sutured, the soft parts brought together, the skin closed, and the extremity encased in plaster.

Variations in the application of the graft to different types of cases will readily suggest themselves. Fixation should be used for from ten to twelve weeks as Gallie as shown that two months is the average time at which absorption is complete.

In reporting his end-results, the author considers those operations successful in which firm union has taken place according to both x-ray and clinical evidence. The series includes twenty-two cases. Operations on seven of ten patients with radial defects were successes and three were partial failures. One ulnar defect, partially successful, refractured at operation. There were five patients with defects of both radius and ulna, one partial and four complete successes. All operations for humeral defects were failures. One defect of the tibia and jaw each was successfully repaired. Eleven patients had more or less suppuration following operation. Refracture occurred in seven, or almost one-third of the twenty-two cases. The bone graft always broke in the middle, the end being united to the matrix bone.

The author concludes that the rib-grafting is a feasible procedure and survives very well even in the presence of suppuration. The grafts absorb rapidly and hypertrophy slowly. They are inferior to tibial grafts in the repair of large defects and in the ability to bear strain. Of twenty-two cases, three were

failures, thirteen were successes, and six were partial successes.—*A. C. Johnson, Rochester, Minnesota.*

TREATMENT OF COMMINUTED FRACTURES OF THE MANDIBLE. By H. A. Potts, M. D., Chicago. *Jour. A. M. A.*, Vol. 75, No. 18, Oct. 30, 1920.

The general plan of treatment of mandibular fractures must be kept in mind, namely, the reduction of all viable fragments and the retention of all teeth, if they are not detrimental to repair. Teeth should be kept in their normal occlusion and all bone fragments and osteogenic tissues in as nearly normal position as possible. Efficient drainage, as indicated either before or after reduction and retention, is all important, as these cases are almost invariably infected.

If the patient has been seen early and presents an open wound, all dead soft tissues and detached bone fragments and foreign bodies should be removed. Small attached fragments may be temporarily wired to larger ones or to a splint used to immobilize them. Circumferential wiring may be employed to draw into place and retain larger fragments, the wire being passed around the bone and twisted over a splint.

When the bone is badly comminuted, the parts may be molded and held more or less satisfactorily in place by modeling composition below the chin, at least until, by plastic exudate, the parts become a little more stable, when they may be better retained by another appliance.

It is desirable when teeth and much bone have been lost, to hold the remaining periosteum in its normal relationship as, in many cases, by regeneration of bone in its proper place, bone grafting may be facilitated or in some cases avoided. Fragments of teeth, fillings and roots should be sought for in the soft tissues, as many times they have been found quite distant from the site of fracture. Tooth roots exposed in the line of fracture should be removed, although at times they may be utilized temporarily for the retention of a fragment. Their retention may be at the expense of union, as they are frequently the sole cause of nonunion.

Retarded union is often due to the presence of a devitalized tooth whose root, even though it may be some distance from the line of fracture, exhibits a restraining influence due, no doubt to bacteria or toxins retained within the canal; and in such a case the roentgenograms may be negative.

At times we may be justified in retaining a large sequestrum involving the diameter of the bone, provided the wound is draining freely and it is frequently irrigated in order that the periosteum may mold the new bone supplying the lost part.

Potassium permanganate, 1:1,000 or even stronger, is one of the best medicaments to control the fetid odor, which is very marked in most of these cases. The use of the douche-can irrigator three or four times daily is essential, and the patient should have a supply of his own which he should use every hour as a mouth wash.

In general, each case should be considered from three standpoints: (1) the restoration of bony jaw; (2) the restoration of mastication; (3) the cosmetic result.—*Leo C. Donnelly, Detroit.*

BONE AND JOINT TUBERCULOSIS. By Dr. Scharff. *Archiv. f. Orthopaed. und Unfall-Chirurgie.* XVIII Band. ½ Heft. 1920 Seite. 282.

The treatment of bone and joint tuberculosis has in the last few years undergone various changes. The purely operative procedures, especially the joint resection, has been more and more abolished. Of all operations Albee's has survived the test and has proven useful and efficient in the hands of most orthopedic surgeons. Except the latter, no other extensive surgical procedures are practised; only puncture of the tuberculous abscesses and suppurating joints followed by injections of 5-10% Iodoformglyzerin or Iodoform-Humanol (humanfat) or Iodin-Iodoformglycerin is still advocated.

The conservative treatment consisting of immobilisation of the affected extremity in plaster of Paris splint or jacket for spinal tuberculosis is the therapy at present in vogue. Natural and artificial sunlight, and the specific tuberculins are extensively used and advocated by the various authorities of this subject, in addition to the rest of the diseased parts. Of the specific treatment is mentioned the partial antigen of Much-Deyke and the Friedmann's tuberculin. The latter has gained many adherents who have reported favorable results particularly in the beginning stages of bone and joint tuberculosis. Much-Deyke partial antigen is used therapeutically and diagnostically; it is recommended particularly for the purpose of diagnosis in doubtful cases.—*A. Gottlieb, San Francisco, Calif.*